REMARKS

Claims 1-14 were pending in the patent application. By this amendment, Claims 3, 7, and 11 are canceled and Claims 15-17 have been added. While the total number of claims remains the same, an additional filing fee of $258.00 is required for introduction of three new independent claims. Authorization is given to charge Deposit Account 50-0510 for the additional filing fee.

The Examiner has rejected Claims 1, 4, 5, 8, and 13 under 35 USC 102 as anticipated by Richardson; Claims 9, 12, and 14 as anticipated by Zhang; Claims 2, 3, 6, 7, 10 and 11 as being unpatentable over Richardson in view of Bond, although teachings from the Zhang paper are referenced in the rejections of Claims 10 and 11. Applicants respectfully request clarification of the rejections of Claims 10 and 11. For the reasons set forth below, Applicants believe that the claims as amended are patentable over the cited art.

The present invention is directed to a system and method for low-density parity-check (LDPC) encoding of data, wherein the LDPC codes are designed to exhibit the desired triangular structure in their parity-check matrices without

resorting to random or semi-random constructions, without the need for costly pre-processing, and which offer excellent performance. The resulting parity check matrix is deterministic and can be specified by only three parameters, which leads to a straightforward triangular structure and LDPC codes having linear-time encoding complexity. Two triangularization methods are detailed and claimed that maintain the deterministic nature of the parity check matrix. The first method, detailed with reference to Fig. 6 from page 10, line 24 through page 14, line 18, is based on the judicious partitioning of the parity check matrix H = [H1][H2] and replacing H1 with a triangular matrix, followed by the optional step of removing all 4-cycles generated by the process. This first embodiment is the subject of the amended Claims 1-2, 5-6, 9-10, 13 and 14. The second embodiment provides triangularization by shifting the rows of the matrix H which can be made triangular without exhibiting any 4-cycles by construction. That embodiment is claimed in independent Claims 15-17 and in Claims 4, 8, and 12 which depend respectively from Claims 15-17. Applicants have amended the claims to recite these methods in greater detail.

Applicants respectfully assert that the cited references do not anticipate or obviate the invention as claimed. The prior art references are directed to the triangular parity-check matrix structure for linear-time encoding. As taught in the Specification (e.g., page 5, line 1 through page 6, line 9), the prior art constructions have drawbacks. The prior art constructions are based on a random or semi-random parity check matrix for which the code cannot be specified via a small number of parameters. In addition, the prior art methods require computationally intensive pre-processing steps in order to bring the parity-check matrix to an "approximate" triangular form. In contrast, the present invention provides LDPC codes which exhibit the desired triangular structure without requiring semi-random constructions and without pre-processing.

The Richardson article was cited in the Specification as an example of prior-art LDPC codes which are random or semi-random. Richardson provides an algorithm that, through row and column permutations, brings the parity-check matrix to an "approximate lower triangular form" (page 641, section II). They call the steps "preprocessing" (page 641, column 1, lines 28-30 and page 642, column 1, lines 17-22) and it

is computationally involved since singular cases may arise. Applicants point out that the claims do not claim the triangular parity-check matrix structure for linear-time encoding and do not claim the back-substitution (page 641, paragraph 2 of Richardson) or the row and column permutations (page 641, paragraph 4) of Richardson. Rather, Applicants are claiming unique method steps, apparatus, and computer program products for triangularization methods that maintain the deterministic nature of the parity-check matrix, which do not require preprocessing steps, and which are neither taught nor suggested by Richardson. As noted above, Applicants have amended the claims to recite the inventive methods in greater detail. Applicants believe that the Richardson paper does not teach or suggest the invention as now claimed.

Similarly, the Zhang article is directed to low-density parity-check codes to construct an "approximate upper triangular GLD parity check matrix which defines a class of efficient-encoding GLD codes" (Abstract on page 2477). However, the Zhang article does not teach or suggest the triangularization steps and means as set forth in the present claims. Zhang, like Richardson, introduces column

that Richardson or Zhang anticipates the language of independent Claims 15-17, or of Claims 4, 8 or 12 which depend respectively therefrom. Accordingly, Applicants respectfully request withdrawal of the anticipation rejections.

The Bond reference has been cited in conjunction with Richardson in rejecting Claims 2, 3, 6, 7, 10, and 11. While Claims 3, 7 and 11 have been canceled, their limitations are now included in newly added Claims 15-17. As noted above, the basis for rejecting Claims 10 and 11 is somewhat confusing, since the Examiner rejects the claims based on Richardson but cites some passages from Zhang. Applicants respectfully request clarification of the rejections. In addition, Applicants respectfully assert that it would not be appropriate for the Examiner to issue a Final rejection in response to this amendment, since Applicants are unable to respond to the unclear rejections.

Bond is directed to a method for constructing low density parity check codes to improve performance in the use thereof. Bond does state that it is desirable to eliminate 4-cycles and 6-cycles. However, Applicants respectfully assert that the Bond article does not teach or suggest the

triangularization method as claimed, and that the Bond teachings relating to the undesirability of small cycles do not teach or suggest the claimed eliminating of 4-cycles from a second matrix generated by the claimed steps (Claims 2, 6, and 10) or the cyclical shifting of rows (formerly Claims 4, 7, and 11, now in Claims 15-17). Accordingly, Applicants believe that a prima facie case of obviousness has not been made by the Examiner, since not all of the claim features are taught or suggested by the cited references.

Based on the foregoing amendments and remarks, Applicants respectfully request entry of the amendments, reconsideration of the amended claim language in light of the remarks, withdrawal of the rejections, and allowance of the claims.

Respectfully submitted,
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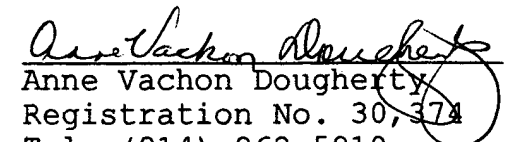
By: 
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